

KYLEX

Intelligent
Display



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An Affiliate Of **EXXON** Enterprises Inc

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News Release



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FOR IMMEDIATE RELEASE

KYLEX, INC. INTRODUCES FIRST PRODUCT:
ONE-LINE, 40-CHARACTER, DOT MATRIX LIQUID CRYSTAL
DISPLAY SYSTEM WITH INTEGRAL ELECTRONICS
FOR MICROPROCESSOR INTERFACE

MOUNTAIN VIEW, Calif. — Kylex, Inc., an affiliate of Exxon Enterprises Inc., has introduced a one-line, 40-character 5x10 dot matrix liquid crystal (LC) display system with integral electronics — the LX140 — that can interface directly with microprocessors through a single peripheral parallel interface device.

Aimed initially at electronic typewriter/word processing and terminal printer applications, the LX140 flat display panel is a low-power, low-voltage system with integral drive, refresh, temperature compensation and power supply electronics.

According to Terry Leeder, Marketing Manager, "The LX140 Liquid Crystal Display is intended to offer a low cost, technologically compatible, intelligent display medium for the rapidly expanding microprocessor based equipment market. With its 5 volt power supply, low current drain, and simple interface, the display system can directly interface with standard semiconductor technology designs. The 5x10 dot matrix alphanumeric display capability provides the human interface to the microprocessor for control, instruction and feedback purposes."

MORE

The LX140 liquid crystal display is ideal for use in high ambient light conditions, resulting in a high resolution, flicker-free flat display to reduce eye strain. The display is fully hermetic, enhancing long-term reliability. The display is assembled in a compact, rugged and lightweight enclosure, providing the user ease of mounting, equipment portability, and an environmentally-resistant unit for all commercial display applications.

A 5x10 dot matrix for each character provides display capability for the full ASCII character set — including lower case descenders and underline and the microprocessor interface capability allows the user to keep his systems interface cost low, while the on-board memory and refresh features minimize the display systems demands on the user's host system.

On-board electronics of the LX140 include custom CMOS LSI drive chips that incorporate the integral read-write (RAM) memory for all 2000 display elements, with each dot addressable. On-board circuitry also generates all refresh signals, thus eliminating the need for continuous data transfer to the display module. Additional circuitry provides temperature compensation to ensure optimum display optical characteristics and a DC to DC converter for generating the required internal voltage.

All of the LX140's input/output lines are compatible with 5V logic families, and the unit operates from a single plus-5 volt power supply with power drain typically less than 400 milliwatts (600mW maximum). A 20-pin socket connector allows easy interfacing to the user's system.

MORE

Operating temperature range is 10°C to 55°C; storage temperature range is -20°C to +70°C; and ambient light range is 10 footcandles (min.). The LX140 features a high reflectivity/contrast ratio with a wide viewing angle.

Price of the LX140 display at the 100-up quantity level is \$199, FOB, Mountain View. Availability is six weeks for evaluation quantities. For higher-volume requirements, contact Kylex.

In January, 1978, Exxon Enterprises Inc. established the venture now called Kylex to investigate the development of large-area, high-information density liquid crystal displays.

CAPTIONED PHOTO ENCLOSED

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For more information contact Terry Leeder or Wayne Fischer at KYLEX, 420 Bernardo Avenue, Mountain View, CA 94043, (415) 969-5200.

Editors may also contact Paul Plansky at PLANSKY PUBLIC RELATIONS, (415) 327-6326.

LX 140 Pricing

1-9	\$299
10-24	\$269
25-49	\$249
50-99	\$229
100-	\$199

ALL PRICING F.O.B. MOUNTAIN VIEW, CA



Kylex, Inc., an Exxon Enterprises Affiliate, has introduced its first product: The LX-140, a one-line, 40-character 5x10 dot matrix liquid crystal display system with integral electronics that can interface with microprocessors through a single peripheral interface device. At the 100-quantity level, the LX-140 is priced at \$199, FOB, Mountain View, Calif. Availability is six weeks for evaluation quantities. For higher-volume requirements, write Kylex at 420 Bernardo Ave., Mountain View, CA 94043; or phone (415) 969-5200.

LX140

40 Character 5x10 Dot Matrix Liquid Crystal Display System

The LX140 is a complete 40 character (5x10 dot matrix) liquid crystal display system that can interface directly with microprocessor systems through a peripheral interface chip. It provides

a rugged, low power, low voltage display system for use in word processors, teleprinters, electronic typewriters, computer terminals and other electronic equipment requiring intelli-

gent readout. Its liquid crystal display is ideal for use in high ambient light conditions, providing a bright, flicker free, flat display to minimize eye strain.



General Description

The LX140 is a complete, self-contained liquid crystal display system that is capable of displaying one line of 40 alphanumeric characters. The unit includes the liquid crystal display plus all necessary drive electronics in a rugged, sealed enclosure.

The multiplexed liquid crystal display panel contains 2000 individual display elements arranged in 10 rows of 200 columns. This arrangement provides 40 character blocks, each consisting of 5x10 dots, with an intercharacter space between blocks. The 5x10 dot matrix provides display capability for the full ASCII character set *including lower case descenders and underline*.

The LX140 display system also includes custom integrated CMOS

drive circuits and temperature compensation circuitry to provide the necessary multiplex drive signals to the LC display. The system is packaged in a rugged, sealed enclosure, which provides an environmentally resistant display product suitable for all commercial display applications.

The multiplexed drive signals have been carefully matched with the liquid crystal material parameters to provide the widest possible viewing cone and maximum contrast ratio. Specification of the LX140 visual performance parameters is provided in the attached polar plot.

The LX140 includes the novel feature of on-board memory for all 2000 display elements. This memory is organized as read-write RAM with each dot addressable. The on-board circuitry also generates all refresh

signals. This eliminates the need for continuous data transfer to the display module. *Display data is entered from the system data bus only when needed to change a character.* The displayed data may also be read from the display system.

The LX140 provides the user with remarkable ease of interface. Addressing the display system is equivalent to addressing memory with a one-to-one correspondence between bits of memory and dots in the display. All input/output lines are CMOS and LSTTL compatible.

The LX140 operates from a *single +5 volt* power supply. Power drain is typically less than 400 milliwatts.

Application note LXA1, available upon request.

Features

- Compact, integrated alphanumeric display system.
- One line of 40 characters (1x40).
- 5x10 dot matrix for each character provides full 5x7 alphanumeric display capability including lower case descenders and underline.
- Interfaces directly to micro-processor through a peripheral interface chip.
- High resolution, flicker free, flat display.
- High reflectivity/contrast ratio with wide viewing angle.
- On-board memory and refresh for all display elements.
- On-board temperature compensated drive circuitry.
- Fully hermetic LCD display for long term reliability.
- Exceptionally easy interface; 20 pin socket connection.
- CMOS and LSTTL compatible.
- Simple power requirement; operates from single +5V supply.
- Low power dissipation; 400 mW typical.

Maximum Ratings

Power Dissipation	600 mW max.
Operating Temperature Range	0°C to +55°C
Storage Temperature Range	-40°C to +70°C
Ambient Light Range	10 footcandles minimum, No effective maximum.

OPERATING CHARACTERISTICS at 25°C

Optical	Symbol	Min	Typ	Max	Units
Contrast Ratio (PEAK)		20:1			
Viewing Cone, to 2:1 Contrast Horizontal		+40° -40°			Degrees (Note 2)
Vertical		+5° -50°			Degrees (Note 2)
Switching Speed @ Point of max contrast	T _{on}		150		Msec
20° from normal along 6:00 axis	T _{off}		150		Msec

DC Electric Characteristics

Operating Voltage	V _{CC}	4.75		5.25	Volts
Logic "1" Input Voltage	V _{IH}	3.0			Volts (Notes 4 & 5)
Logic "0" Input Voltage	V _{IL}			0.8	Volts
Logic "1" Output Voltage @ I _{OH} = 200 μ A	V _{OH}	2.7	3.4		Volts
Logic "0" Output Voltage @ I _{OL} = 1 μ A	V _{OL}	0.25		0.4	Volts
Power Supply Current @ V _{CC} = MAX			80	120	mA
High Impedance State Output Current	I _{OHZ}	-50		50	μ A
Logic "1" Input Current	I _{IH}			40	μ A
Logic "0" Input Current	I _{IL}			-0.8	μ A

AC Electrical Characteristics

Address, Data, R/ $\bar{W}$ to $\bar{E}$ Timing	t _s	200			ns
$\bar{E}$ Pulse Width, Write	t _{EW}	2		50	μ s
Address, Data R/ $\bar{W}$ hold after $\bar{E}$	t _{WH}	50			ns (Notes 3 & 6)
Data Access from $\bar{E}$	t _{AE}			4	μ s
$\bar{E}$ Pulse Width, Read	t _{ER}	4		50	μ s (Notes 3 & 6)
Data Valid after $\bar{E}$	t _{DV}	70			ns
Address Hold, Read	t _{RH}	0			ns

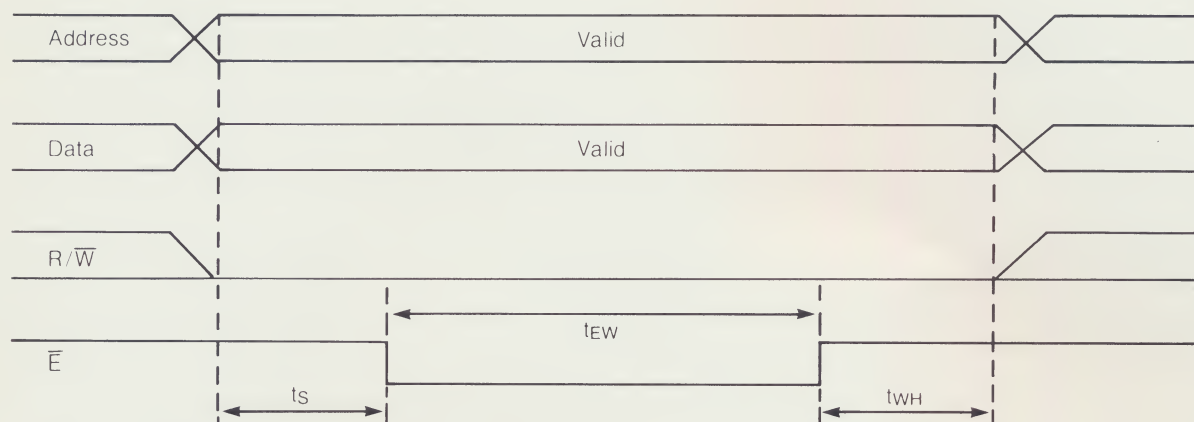
Operating Life

50,000 hours (Typical)

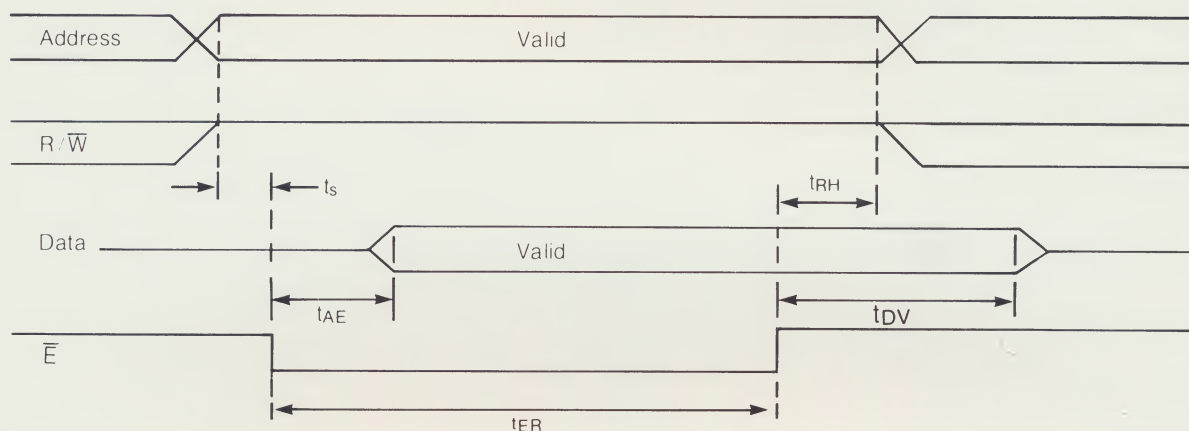
Notes

- See polar plot for typical representation of viewing cone.
- While $\bar{E}$ is held low display is not refreshed. If $\bar{E}$ is held low continuously, the display will not function.
- Except A₇, A₈, A₉ which are inputs to a CMOS device. V_{IH} min. to these devices is 3.5 volts. The LX140 provides internal 2K pull-up resistors to V_{CC} to facilitate compatibility with user's LSTTL outputs.
- A₄, A₅, and A₆ are direct inputs to the CMOS display drivers. V_{IH} min. is 4.0 volts. It is recommended the user provide 10K pull up resistors to V_{CC}.
- The $\bar{E}$ rise time should be < 20 nsec. $\bar{E}$ capacitance input is 125 pf. It is recommended the user provide a 2K pull-up resistor to V_{CC}.

Write Cycle Timing



Read Cycle Timing



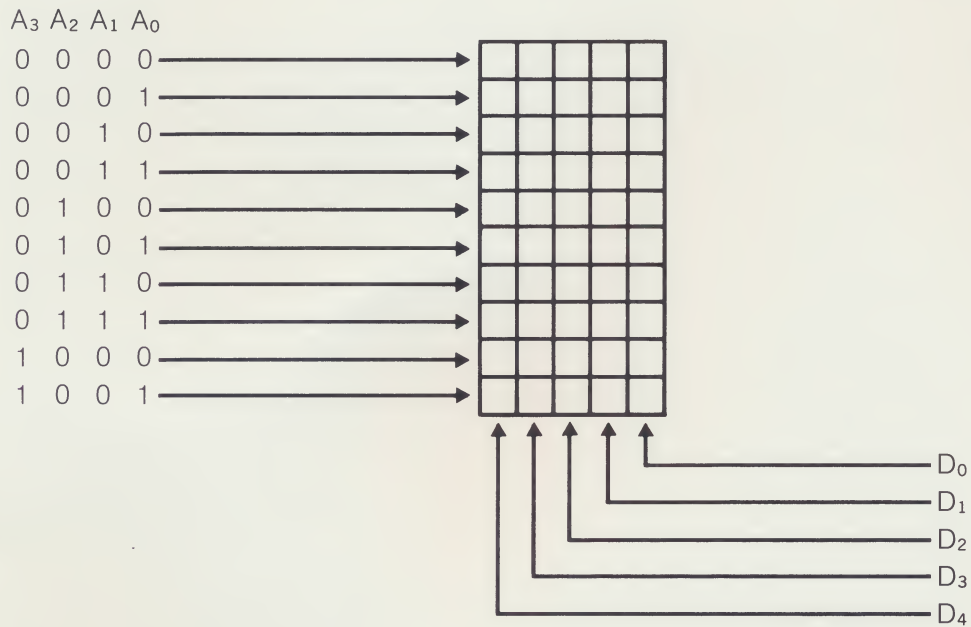
Electrical Addressing Method

The LX140 display system is addressed as a RAM with a 5 bit word architecture. Each character consists of ten rows of 5 bit words. The user supplies

dot information together with the appropriate *row and character address locations*. A 5 bit parallel data bus is used for dot input corresponding to the five dot wide character blocks.

Once input, the display system's internal semiconductor memory retains the input data. The display system requires no scan, clock refresh or periodic data update.

Character Cell Row Address and Data Organization



Character Address Organization (A9-A4)

The character address space is shown here. It is important to note that hex codes X7 and XF are skipped. Character 0 is the left most character in the display.

Character No.: (Decimal)	Address (Hex)	Character No.: (Decimal)	Address (Hex)
0	00	20	16
1	01	21	18
2	02	22	19
3	03	23	1A
4	04	24	1B
5	05	25	1C
6	06	26	1D
7	08	27	1E
8	09	28	20
9	0A	29	21
10	0B	30	22
11	0C	31	23
12	0D	32	24
13	0E	33	25
14	10	34	26
15	11	35	28
16	12	36	29
17	13	37	2A
18	14	38	2B
19	15	39	2C

Signal Description

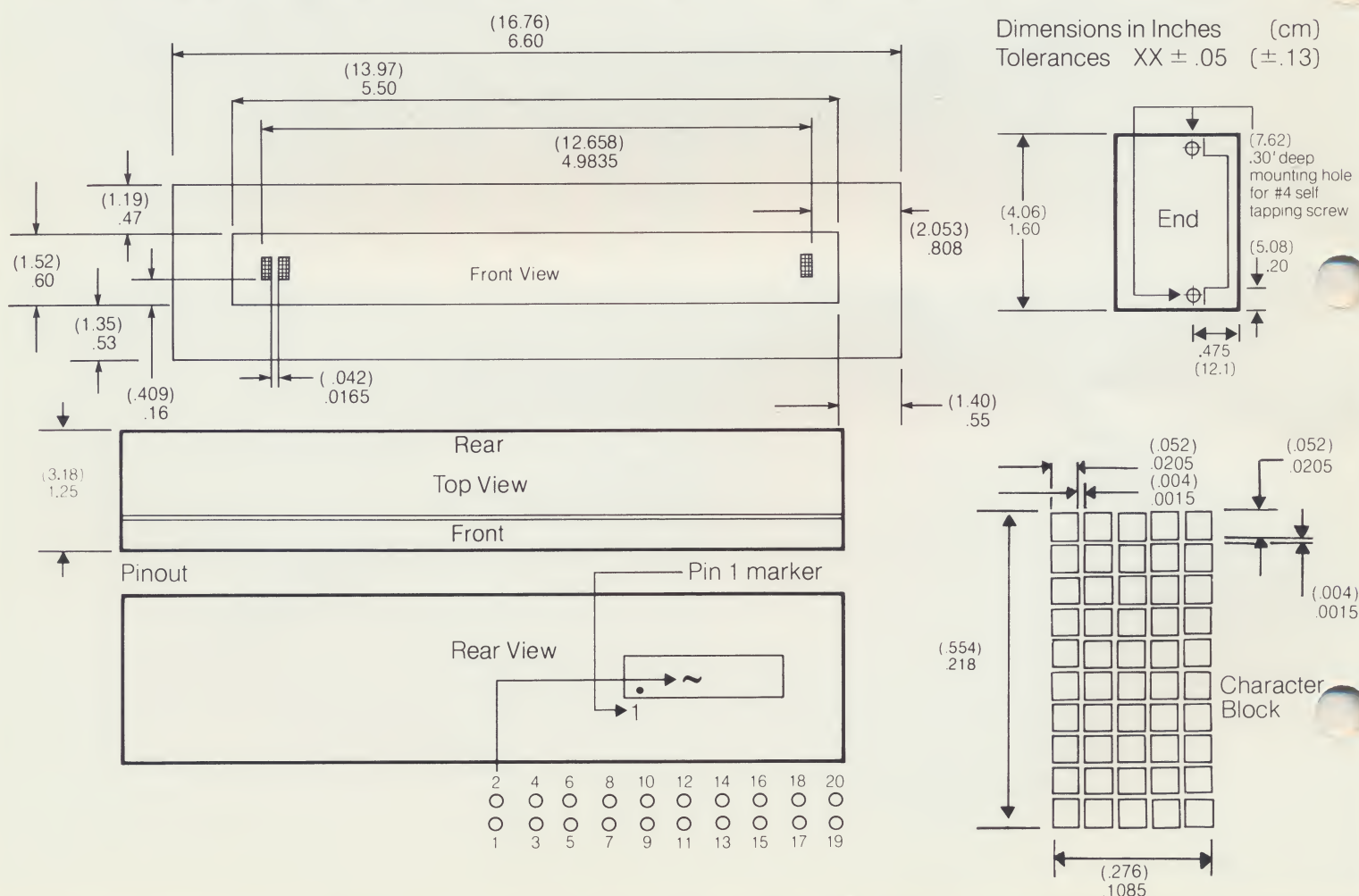
$V_{CC} \quad 5V \pm 5\%$

R/ $\bar{W}$ Negative true write line.

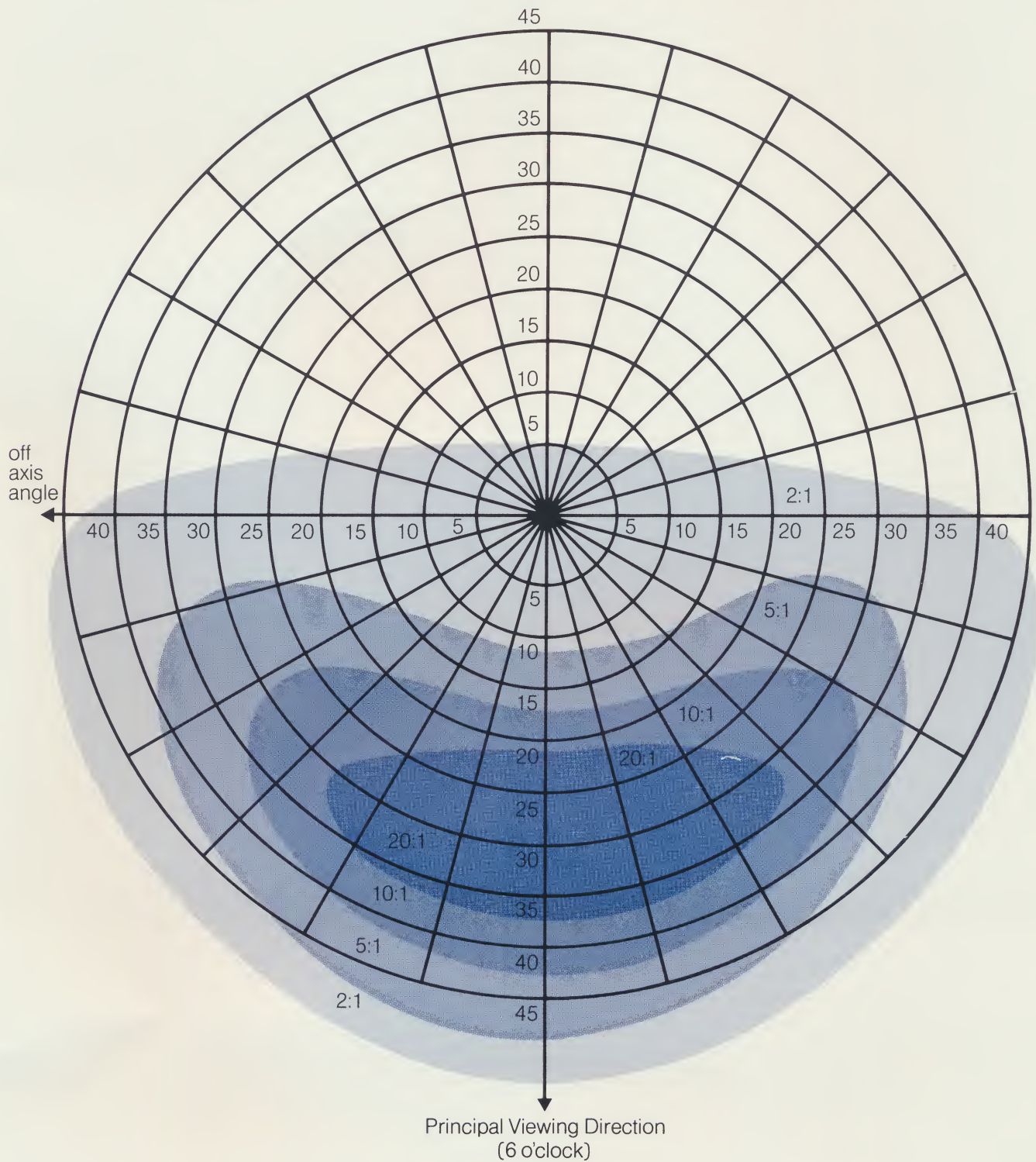
A0–A3 Row address; least significant bit is A0.

A4–A9 Character address; least significant bit is A4.

A10 N/C pin not to be used as a tie point.
May be a logic "1" or "0."



Polar Plot of Viewing Cone



Note: The display is positioned at the origin of the plot, with its face located in the plane of the page and the line of characters oriented horizontally.



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